

NON-PUBLIC?: N  
ACCESSION #: 9406280301  
LICENSEE EVENT REPORT (LER)

FACILITY NAME: South Texas Unit 1 PAGE: 1 OF 4

DOCKET NUMBER: 05000498

TITLE: Manual Reactor Trip Due to Malfunctioning Main Feedwater  
Regulating Valve  
EVENT DATE: 02/28/94 LER #: 94-009-01 REPORT DATE: 06/23/94

OTHER FACILITIES INVOLVED: DOCKET NO: 05000

OPERATING MODE: 1 POWER LEVEL: 29

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR  
SECTION:  
50.73(a)(2)(iv)

LICENSEE CONTACT FOR THIS LER:  
NAME: Jairo Pinzon - Staff Engineer TELEPHONE: (512) 972-8027

COMPONENT FAILURE DESCRIPTION:  
CAUSE: X SYSTEM: JB COMPONENT: CNV MANUFACTURER: F130  
X JB TC W120  
REPORTABLE NPRDS: YES  
YES

SUPPLEMENTAL REPORT EXPECTED: NO

#### ABSTRACT:

On February 28, 1994 at 2212 hours, Unit 1 was in Mode 1 at 29% power when a steam flow/feed flow mismatch alarm was received on Steam Generator ID. The reactor was manually tripped at 2213 hours following an unsuccessful attempt to take remote manual control of the ID Main Feedwater Regulating Valve. The malfunction of the 1D Main Feedwater Regulating Valve was caused by a failed transformer coil in the torque motor in the current to pneumatic convertor (Fisher Controls Type 546 Current to Pneumatic Converter). The root cause of the failed transformer coil has been attributed to a weak solder connection on one end of a wire which connects the two sets of transformer coils together in the torque motor section of the convertor. Corrective actions include performing failure analyses on the current to pneumatic convertor and the associated Westinghouse 7300 Series driver card which had failed and was

replaced earlier. The failed current to pneumatic convertor was replaced as were two other Unit 1 current to pneumatic convertors.

END OF ABSTRACT

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#### DESCRIPTION OF EVENT

On February 28, 1994 at 2212 hours, Unit 1 was in Mode 1 at 29% power when a steam flow/feed flow mismatch alarm was received on Steam Generator 1D. Attempts to control the 1D Main Feedwater Regulating Valve via remote manual control were unsuccessful and a manual reactor trip was initiated at 2213 hours. NRC was notified at 2327 hours via the Emergency Notification System. This event is reportable in accordance with 10CFR50.73 (a)(2)(iv).

There had not been any significant perturbations in steam flow or in feed flow to the 1D Steam Generator for approximately three hours prior to this event. Steam Generator Feed Pump 13 had been placed in service three and one-half hours earlier causing a feed flow perturbation. The level control system for the 1D Steam Generator exhibited quarter-wave damping during this perturbation indicating a finely tuned control loop. A steam flow/feed flow mismatch alarm was received on Steam Generator 1D at 2212 hours. The Reactor Operator attempted to take remote manual control of steam generator level but the 1D Main Feedwater Regulating Valve would not respond. Steam Generator 1D level continued to decrease and the reactor was manually tripped at 2213 hours. The level in Steam Generator 1D was approximately 40%. An automatic trip on low steam generator level occurs at 33%. The Main Turbine tripped and a low T-average Feedwater Isolation occurred as expected. This was followed by an expected auxiliary feedwater actuation on Steam Generator 1D Level Lo-Lo. The plant was stabilized in Mode 3.

#### CAUSE OF EVENT

The cause of the plant trip was the inability to regain control of 1D Main Feedwater Regulating Valve prior to placing the plant in a safe condition. A causal factor contributing to the event included a hard failure of the I/P Converter which prevented taking remote manual control from the control room.

The malfunction of the 1D Main Feedwater Regulating Valve was caused by a failed transformer coil in the torque motor in the current to pneumatic convertor (Fisher Controls Type 546 Current to Pneumatic Convertor). The transformer coil was found to be open circuited resulting in a "fail low" pneumatic signal to the valve positioner. This resulted in the closure of

the ID Main Feedwater Regulating Valve and the subsequent loss of feedwater flow to the ID Steam Generator.

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#### CAUSE OF EVENT (Continued)

The root cause of failure of the I/P Convertor has been attributed to a weak solder connection on one end of a wire attached to the transformer coil. This wire connects the two sets of transformer coils together in the torque motor section of the convertor. The manufacturer of the convertor, Fisher Controls, has provided a failure analysis report and has responded to several questions raised by this investigation. Fisher's response indicated no specific life expectancy for the convertor, no acceptable test available to predict an open circuit failure, and only two records describing this mode of failure out of a population of almost a half million manufactured units.

Preventive actions had been taken during the unit outage maintenance period prior to this event to verify operation of the Main Feedwater Regulating Valves. All four Unit 1 Main Feedwater Regulating Valves and their current to pneumatic convertors had been successfully calibrated on November 13, 1993. No component replacements were necessary and all of the current to pneumatic convertors were found to be in calibration.

The Westinghouse 7300 Series driver card, which provides current input signals to the 1D Main Feedwater Regulating Valve current to pneumatic converter had failed and was replaced on February 25, 1994. The root cause of failure of the NCD Card four days prior to the I/P Convertor failure has been attributed to the shorting of pins 8 and 9 in the inverter chip W50-4 under heat testing. This mode of failure correlates with the failure effect observed in the control loop: an automatic control to manual control swap with the inability to return to automatic control. Based upon these failure analysis reports, there is no plausible relationship between the NCD card and I/P Convertor failures which would indicate one failure inducing the other. An analysis of the NCD Card circuitry shows that the maximum voltage output from the card is limited to 40 VDC. Fisher Controls has responded that, although the Type 546 I/P Convertor specification is limited to 30 VDC, a 40 VDC input would not have caused a coil failure.

#### ANALYSIS OF EVENT

Loss of normal feedwater flow is classified as a moderate frequency event in the Updated Final Safety Analysis Report. This type of event is not expected to result in fuel rod failures or in reactor coolant system or

secondary system overpressurizations. Additionally, the auxiliary feedwater system initiated automatically as designed, providing an alternate source of feedwater to the ID Steam Generator. Therefore, there were no adverse radiological or safety consequences resulting from this event. This event is reportable in accordance with 10CFR50.73(a)(2)(iv).

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#### CORRECTIVE ACTIONS

The following corrective actions either have or will be taken as a result of this event:

1. The D train Main Feedwater Regulating Valve current to pneumatic convertor was replaced and its valve control loop calibrated. The B and C train current to pneumatic convertors were also replaced because there was no history of previous replacement. The A train current to pneumatic converter had been replaced on January 14, 1993, and is operating properly.
2. The failed Westinghouse 7300 Series driver card and the failed Fisher Controls Type 546 current to pneumatic convertor were returned to their respective manufacturers for failure analysis.
3. All four Unit 2 Main Feedwater Regulating Valve current to pneumatic convertors have been replaced to improve reliability.
4. Houston Lighting & Power will evaluate the Main Feedwater Regulating Valve control loop for single point failures and revise/create preventive maintenance actions, as necessary, to preclude failure of sub-components which cause a plant trip. This evaluation will be completed by October 15, 1994.
5. Houston Lighting & Power will develop a plan of action in the area of NCD card inverter W50-4 to address the reliability of control loops employing retrofitted cards. This plan of action will be completed by August 1, 1994.

#### ADDITIONAL INFORMATION

A previous similar event described in Licensee Event Report 92-010 for Unit 2 resulted from the failure of a Westinghouse 7300 Series driver card. The power supply and the primary clock counter were determined to be the specific components whose failure led to the loss of card output.

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The Light  
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Houston Lighting & Power

June 23, 1994  
ST-HL-AE-4823  
File No.: G26  
10CFR50.73

U.S. Nuclear Regulatory Commission  
Attention: Document Control Desk  
Washington, DC 20555

South Texas Project  
Unit 1  
Docket No. STN 50-498  
Revision 1 to Licensee Event Report 94-009  
Regarding a Manual Reactor Trip Due to Malfunctioning  
Main Feedwater Regulating Valve

Pursuant to 10CFR50.73, Houston Lighting & Power submits the attached Revision to Unit 1 Licensee Event Report 94-009 regarding a manual reactor trip initiated as a result of a malfunctioning Main Feedwater Regulating Valve. This event did not have an adverse effect on the health and safety of the public.

This revision incorporates the results of the failure analysis of the failed Westinghouse 7300 Series driver card and the failed Fisher Controls Type 546 current to pneumatic converter. Changes are indicated by revision bars.

If you should have any questions on this matter, please contact Mr. J. M. Pinzon at (512) 972-8027 or me at (512) 972-8664.

J. F. Groth  
Vice President,  
Nuclear Generation

JMP/esh

Attachment: Revision 1 to LER 94-009 (South Texas, Unit 1)

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South Texas Project Electric Generating Station File No.: G26  
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c:

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